## Introduction:
# Advanced Biofuels Task Force Report

In November 2007, when Governor Patrick, Senate President Murray, and House Speaker DiMasi created the Advanced Biofuels Task Force, the price of oil was about $85 per barrel. During the five months that the Task Force has been doing its work, the price has risen roughly 30%, reaching $110 per barrel. There could be no more compelling evidence that the citizens of Massachusetts need alternatives to imported fossil fuels.

In the same five months, many companies and non-governmental organizations involved in advanced biofuels R&D and production delivered to the Task Force and its members, in public hearings and written testimony, a message that has been clear and consistent: Massachusetts has the technological expertise, the start-up companies, and the venture capital to become the global center for advanced biofuels. With state policies providing support and stimulation to the sector while protecting the environment, Massachusetts could create clean energy jobs, temper price volatility for transportation and heating fuels, reduce emissions of greenhouse gases and other pollutants, and provide new options for Massachusetts consumers now held hostage to imported petroleum.

Biofuels are substitutes for liquid petroleum fuels—including gasoline, diesel, and heating oil—derived from renewable organic matter. The need for substitutes is clear: petroleum products used for transportation and heating oil drain billions of dollars from our economy, and petroleum used in transportation alone is responsible for more than a third of the state's greenhouse gas emissions. Due to limited domestic supplies, reliance on petroleum makes the United States dependent on imports from nations around the world, many of them politically unstable. And we in Massachusetts, having no supplies of our own, pay high prices for imports from abroad and from other parts of the country.

Advanced biofuels, which are defined in federal law as those that yield a net lifecycle reduction of at least 50% in greenhouse gas emissions compared with fossil fuels, offer additional benefits for the environment and for the Massachusetts economy. These low-carbon fuels could play a significant role in addressing climate change. They could also prove to be the basis for a new technology-based industry in Massachusetts. As fuels that for the most part have not yet been brought to market, advanced biofuels are in need of the intellectual capital and R&D strength that Massachusetts has in abundance. Once these products reach commercial viability, in-state production of advanced biofuels derived from feedstock grown in Massachusetts could make a dent in our dependence on imported energy sources, generate jobs at home, and boost the state's growing energy sector. In addition, biofuels have the potential to keep marginal agricultural land in production—a boon for a state that values small-scale agriculture as part of its economic and physical landscape.

Massachusetts has the technological expertise, the start-up companies, and the venture capital to become the global center for advanced biofuels.

Tackling the problems associated with our dependence on and use of petroleum will, of course, require a portfolio of policies such as increasing fuel efficiency in vehicles, encouraging energy conservation and efficiency in buildings, and reducing vehicle miles

traveled. The legislature and executive agencies are working on building this portfolio, but advanced biofuels can provide one more piece of the puzzle.

Thus, the charge of the Task Force was to evaluate the promise of advanced biofuels and to chart a path forward to accelerate the research, development, commercialization and expansion of biofuels in the Commonwealth. The Task Force has concluded that there may indeed be substantial benefits for the state associated with advanced biofuels, but that there are major uncertainties as well.

> The task force shall develop a strategic framework to accelerate the development and deployment of commercially viable advanced biofuels, and facilitate expansive biofuel research throughout the Commonwealth.
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> *—Governor Deval L. Patrick, Senate President Therese Murray and Speaker of the House Salvatore F. DiMasi in establishing the Advanced Biofuels Task Force*

From an environmental perspective, assessing the impact of biofuels is not a straightforward exercise. Proponents cite the environmental benefits of biofuels: although combustion of biofuels releases carbon dioxide into the atmosphere the same as fossil fuels, the crops, grasses, and trees from which biofuels are derived can be replanted, with the new growth potentially absorbing as much carbon as is released into the atmosphere. Thus, biofuels could potentially be utilized with no net carbon impact. However, biofuels vary in how much they reduce carbon dioxide emissions compared with their fossil fuel equivalent when the analysis takes fully into account the type of feedstocks utilized, the fuels used to convert and transport the feedstocks, and the land on which the feedstocks are grown. For example, ethanol made from corn will have higher carbon dioxide emissions on a lifecycle basis than cellulosic ethanol made from feedstocks like switchgrass or tree trimmings. In addition, if forests are converted to croplands to grow the feedstocks, use of certain biofuels might yield no reduction, or even cause a rise, in greenhouse gas emissions.

Moreover, the Task Force came to understand that biofuels are but one class of technology that could potentially substitute for petroleum products in powering motor vehicles. As a result, the Task Force was persuaded of the advisability of policies that are performance-based and technology neutral. One such policy that the Task Force recommends is a Low Carbon Fuel Standard (LCFS). A LCFS sets limits on greenhouse gas emissions from vehicle use but does not mandate fuel content or particular technologies for meeting that standard. Such an approach allows the market to drive the development of alternative fuels and technologies at the lowest cost, including not only biofuels but also options such as all-electric vehicles, plug-in hybrids, and hydrogen fuel cells. California is currently drafting regulations to implement its LCFS, which would require a reduction of 10% by 2020 in the carbon intensity, on a lifecycle basis, of vehicle fuel sold in the state.

Like the climate benefits, the economic picture for advanced biofuels is characterized by both promise and uncertainty. In terms of promise, the Task Force estimates the potential production of cellulosic ethanol from Massachusetts feedstocks at about 160 million gallons per year, or 6% of the gasoline consumed in the state in 2006. It finds that Massachusetts is ideally positioned to capture the benefits of companies that develop cellulosic technology. In total, a mature advanced biofuels industry—including technology development, in-state feedstock cultivation, and processing into fuel—could contribute $280 million to $1 billion per year to the Massachusetts economy by 2025, while generating 1,000 to 4,000 permanent jobs and 150 to 760 temporary construction jobs. Including indirect "multiplier" effects, the annual permanent gains could rise as high as $550 million to $2 billion and 2,500 to 9,800 jobs.

However, the Task Force notes substantial uncertainties associated with these estimates. The calculation of benefits assumes the resolution of infrastructure barriers, technological challenges, and the very economic viability of advanced biofuels themselves.

In light of these uncertainties, the recommendations of the Task Force reflect an intention to proceed strategically and cautiously with biofuels development—but to proceed nonetheless. While the remainder of the report presents a broad array of findings and recommendations, the major Task Force recommendations include the following:

- Prioritize efforts to achieve near-term implementation of a regional, technology-neutral and performance-based Low Carbon Fuel Standard (LCFS), with Massachusetts leading the way.
- While a LCFS is being developed, implement targeted transitional mandates, such as requirements for minimum percentages of biofuels in blends of transportation diesel and heating oil. Mandates should require that the biofuels yield substantial lifecycle greenhouse gas reductions, including direct and indirect impacts such as those on land use. Also as an interim measure, exempt cellulosic biofuels from the state gasoline tax with a sunset date. The core ideas of both content mandates and exemption of cellulosic biofuels from the gasoline tax are included in the biofuels bill filed by Governor Patrick, Senate President Murray, and House Speaker DiMasi.
- Support pilot deployment in the state fleet of plug-in hybrid and all-electric vehicle technology in light-duty and heavy-duty vehicles, as well as fuel-efficient flex-fuel vehicles in order to explore the potential of electric propulsion along with biofuels in meeting a LCFS.

- Develop infrastructure necessary for consumer use of biofuels—implement limited-cost investments in equipment for ethanol and biodiesel distribution, such as E85 stations along major state highway corridors, subject to budget constraints.
- Develop standards for full lifecycle evaluation of biofuels that consider their carbon and other environmental impacts, including potential direct and indirect land use impacts. Due to the complexities involved, rely to the extent possible on analyses performed by authorities in other jurisdictions.
- Parallel to progress on biofuels, continue to explore policy options for increasing vehicle efficiency and reducing vehicle miles traveled.